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(54) Rechargeable battery pack for hand portable radio telephone

(57) The telephone 1 is adapted to have removably connected thereto a compact, rechargeable battery 2 selected from at least two different battery types, e.g. high and low energy versions or of different chemical and/or physical composition. The battery (2) is provided with a resistor 7 identifying the battery type and the telephone is provided with a facility 10, 11, 13 responsive to the value of the resistor 7 for determining the type of battery present. Thus it can be arranged that a suitable charging regime is adopted compatible with the battery type, and the telephone may also be rendered inoperative if the resistor 7 is absent or does not matched an expected value. The battery comprises a plurality of elongate rechargeable cells 3 disposed in side-by-side relationship within a housing 5 adapted to enclose the cells intimately in the lateral direction and providing an internal cavity 5a adjacent the ends of the cells accommodating the identifying resistor 7. The resistor 7 may be mounted on a printed circuit board together with a fuse 14 and a temperature sensing thermistor 6.

Fig.1.

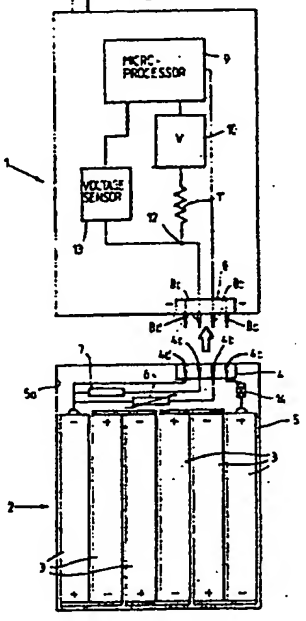

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Fig.1.

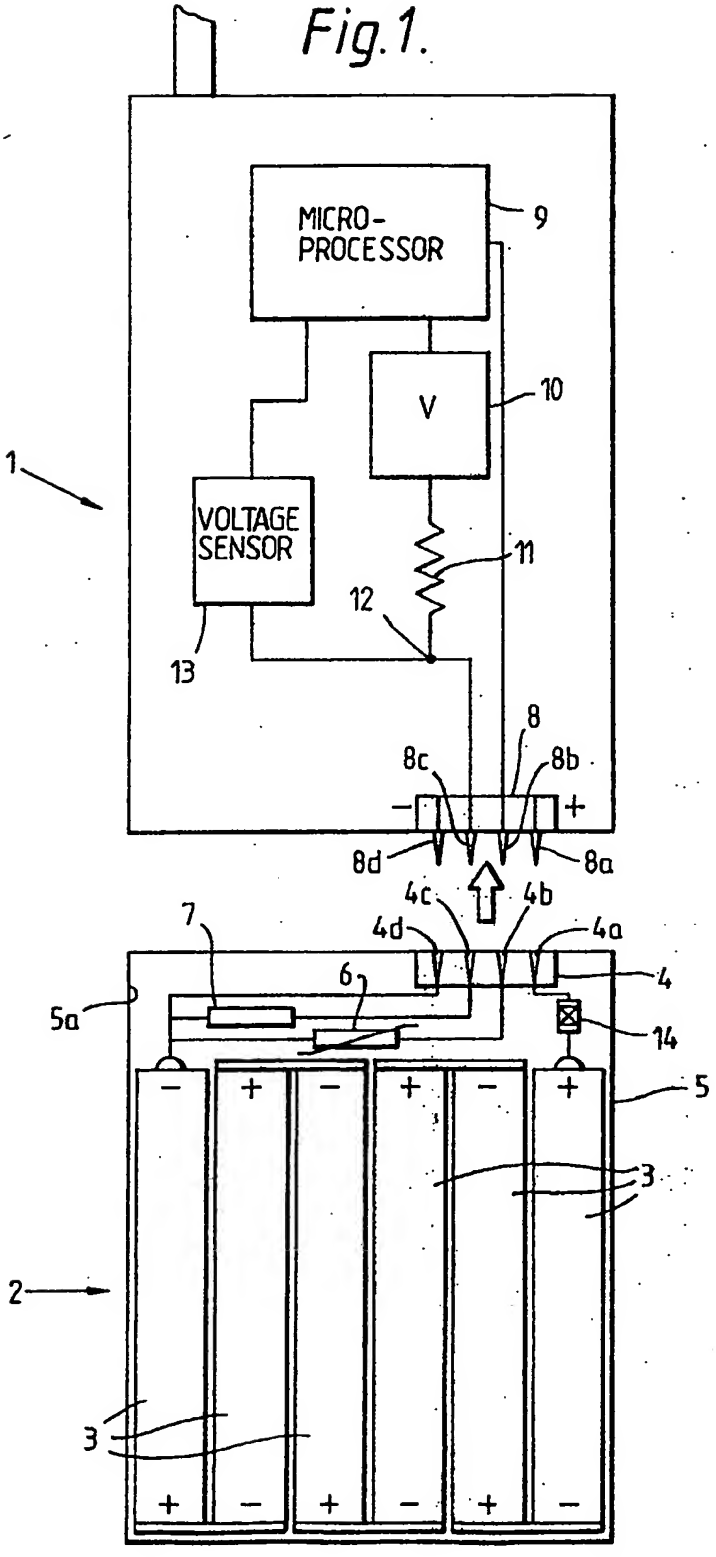
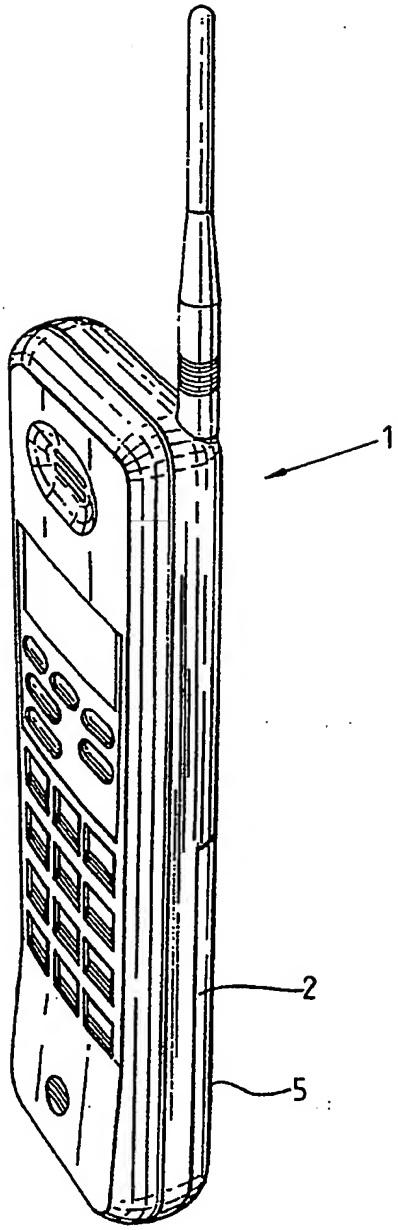

MICRO-
PROCESSOR
9
V
10
1
VOLTAGE
SENSOR
11
12
13
8
8c
8b
8d
8a
4c
4b
4d
4a
7
6
4
5a
14
5
3
2
3

Fig. 2.



BATTERY POWERED RADIO TELEPHONE

This invention relates to a hand portable radio telephone adapted to have removably connected thereto a battery selected from at least two different battery types.

It is nowadays common practice for rechargeable batteries to be used in hand-held radio telephones, such as cellular telephones. However, particularly because of their transmission capability, portable cellular telephones consume a significant amount of power necessitating relatively frequent recharging of the batteries.

High energy batteries are therefore sometimes used when a longer interval is desirable between re-charging. However, the higher the energy of the battery, the heavier and more bulky it tends to be. It is particularly convenient therefore if the telephone is adapted to use interchangeably either a high or low energy battery selected by the user depending on the particular circumstances under which he intends to use the telephone. Hence, a low energy battery would be suitable if the user intends to use the telephone for relatively few short telephone calls over a given period, whereas a high energy battery may be more suitable if it is intended to make longer or more calls over an extended period.

A drawback with using different battery types is that they may require different recharging regimes which, if not adhered to, may adversely affect performance and/or the overall useful life time of the batteries.

European patent application EP-A-0,340,794 discloses a hand portable radio telephone adapted to have removably connected thereto a battery comprising a plurality of rechargeable cells, the battery being selected from at least two different types of battery, said battery further comprising means for identifying the battery type, wherein the telephone comprises means responsive to said identifying means for determining the type of battery connected thereto, the battery further comprising a plurality of rechargeable cells disposed within a housing.

British patent application GB-A-2,219,151 discloses as prior art battery packs which use as identifying means resistors, diodes or the like.

According to a first aspect of the present invention there is provided a hand portable radio telephone adapted to have removably connected thereto a battery selected from at least two different types of battery, said battery comprising means for identifying the battery type, wherein the telephone comprises means responsive to said identifying means for determining the type of battery connected thereto, the battery further comprising a plurality of rechargeable cells disposed within a housing, characterized in that the individual cells are elongate and disposed in side-by-side relationship, in that the housing is adapted to enclose said cells intimately at least in the lateral direction, and in that the housing provides an internal cavity adjacent the ends of said cells, the identifying means being disposed within said cavity.

A radio telephone in accordance with the invention is capable of detecting the type of battery connected thereto and therefore can respond accordingly, especially with regard to the mode of recharging used. A rechargeable battery in accordance with the invention may nevertheless be particularly compact and relatively straightforward to manufacture. Such a battery is therefore eminently suitable for hand portable telephone applications.

It is noted here that the different types of battery may be low and high energy versions of batteries having essentially the same chemical and physical composition or they may alternatively be batteries having different chemical and/or physical composition.

The radio telephone may be adapted to become inoperative if it detects an unrecognisable or unidentified battery.

Suitably the battery type determining means includes means for deriving a signal indicative of the battery type. Specifically, the determining means may include means for generating a reference signal, in which case the identifying means (in the battery) is adapted to modify the reference signal to provide the signal indicative of the battery type.

The battery identifying means may, for example, be formed by a single resistor, the resistance value of which represents the battery type. The battery determining means in the telephone may also comprise a resistor of known resistance value connected to a known voltage source. When the battery is connected to the telephone these two resistors are arranged to be

connected together in the manner of a potential divider whereby the voltage at the junction of the two resistors is indicative of the battery type. Therefore, means are also provided for sensing the voltage between these two resistors.

According to a further aspect of the present invention there is provided a battery for use in a hand portable radio telephone in accordance with the first aspect of the invention, comprising a housing, a plurality of rechargeable cells disposed within said housing, and means for identifying the battery type, characterised in that the individual cells are elongate and disposed in side-by-side relationship, the housing is adapted to enclose said cells intimately at least in the lateral direction, and the housing provides an internal cavity adjacent the ends of said cells, the identifying means being disposed within said cavity.

In a particularly compact implementation of a battery in accordance with the invention the individual cells are substantially rectangular and so occupy minimal volume when configured in a close packed arrangement.

In a preferred embodiment the battery includes means for electrical connection to the portable telephone, the connecting means comprising connectors associated respectively with the positive and negative terminals of said cells and with the identifying means, the connectors being mounted in a unitary insulating member. A further connector associated with means for generating a temperature indicative signal may also be mounted in the same unitary insulating member. Providing the individual connectors in a common insulating member facilitates assembly of the battery.

An embodiment of the invention will now be described by way of example, with reference to the accompanying drawings in which:-

Figure 1 is a schematic illustration of a radio telephone shown separated from an interchangeable battery in accordance with the invention, and

Figure 2 is a perspective view of the radio telephone in Figure 1, with the battery connected to the telephone.

The apparatus shown in Figures 1 and 2 is a cellular portable telephone 1 comprising a rechargeable battery pack 2. The battery pack 2 may for example contain six identical series-connected NiCd cells 3 each having a nominal voltage of 1.2V. The battery pack, therefore, has a nominal voltage of 7.2V. The capacity of the cells is typically 600 mAh for a regular battery pack, whereas in the case of a high energy version the capacity may be, for example, 850 mAh.

The individual cells are rectangular in cross-section and are arranged side-by-side in close packed configuration to yield a particularly compact battery pack 2. In an alternative arrangement the cells may be arranged in two rows of three cells, for example. In any case the cells 3 and associated circuitry (described hereinafter) are intimately enclosed in a housing 5.

The battery housing 5 comprises a socket having four connectors 4a, 4b, 4c, 4d arranged in a straight line and mounted in a unitary insulating block 4. Socket 4a

is connected to the positive terminal of the cells 3 via a fuse 14 and socket 4d is connected to the negative terminal of the cells 3. Socket 4b is connected to the negative terminal (effectively earth) via a thermistor 6 located in the close proximity of the cells 3 so that the signal appearing on terminal 4b is indicative of the local temperature of the battery.

Socket 4c is connected to the negative terminal of the cells 3 (effectively earth) via a resistor 7. The value of the resistor indicates the type of battery being used. For example, the Applicant has used a resistor of 47,000 ohms to identify a regular-energy battery having a capacity of 600 mAh, and a resistor of 68,000 ohms to identify a high-energy battery having a capacity of 850 mAh.

The resistor 7, fuse 14 and connector block 4 are accommodated within a cavity 5a provided in the housing 5 adjacent the ends of the cells 3 nearest the telephone 1, further promoting a compact battery arrangement. The connector block 4 extends into a complementary aperture in the housing 5. To facilitate assembly of the battery the resistor 7, the fuse 17 and the connector block 4 may be mounted on a small, common printed circuit board within the cavity 5a. The thermistor 6 is ideally mounted directly adjacent the cells 3 rather than on the circuit board.

The battery 2 is capable of being connected to the telephone 1 as indicated by the arrow in Figure 1. Figure 2 shows the battery 2 connected to the telephone 1. The battery may be fitted by any suitable mechanical means, for example a battery 2 may be arranged to fit slideably onto the telephone 1. The

telephone comprises an electrical connector 8 comprising protruding conductive pins 8a, 8b, 8c, 8d which engage respectively in the connectors 4a, 4b, 4c, 4d of socket 4 in the battery 2 when the battery is fully inserted on the telephone.

For the sake of clarity the positive and negative terminals 8a and 8d of connector 8 are shown without any further connections. Of course in practice these terminals would be connected to the main telephone circuitry for providing power thereto. It is noted here that the telephone 1 also includes a transceiver and all the other features conventionally found in a cellular telephone, but which also for the sake of clarity are not shown in the Figures. Also, since these aspects of the telephone are not relevant to the instant invention no further details will be given here, except to reiterate that the circuitry in the telephone is connected to the terminals 8a and 8d.

Terminal 8b connects with terminal 4b on the battery and, as mentioned above, the signal appearing thereon is indicative of the local temperature in the circuitry of the battery 2. This signal is applied to a microprocessor 9 within the telephone, which may use this temperature information to compensate for values of the battery voltage monitored during re-charging to give a more accurate indication of the charge state of the battery.

Terminal 8c of the telephone, which contacts connector 4c of the battery, is connected within the telephone 1 to a voltage source 10 generating a known voltage of, for example +5V via a resistor 11 having a known value of, for example, 180,000 ohms. Thus when the battery 2

is connected to the telephone the resistor 11 in the telephone is connected in series with the resistor 7 in the battery 2 in the manner of a potential divider. Indeed, the voltage at the junction 12 between the two resistors 10 and 7 indicates the value of the resistor 7 in the battery and hence is representative of the type of battery connected. For example with the values mentioned herein, when a regular-energy battery 2 is in use the voltage at junction 12 will be 1V, and when a high energy battery is used the voltage at junction 12 will be 1.5V.

A voltage sensor 13 is used to monitor the voltage at junction 12 and to feed a signal indicative thereof to microprocessor 9. The microprocessor may respond particularly for example during recharging to ensure that the battery is recharged in accordance with a mode compatible with the battery type. To this end the telephone may be adapted to be coupled to a charging unit capable of operating in different charging modes in response to a control signal generated by the telephone, and managed by the microprocessor, as described and claimed in our co-pending British patent application No. 9007683.7 (Our Ref PAT 90005).

Additionally or alternatively the microprocessor 9 may respond by rendering the whole telephone inoperative if a battery is used which does not include an identifying resistor, of if the value of such a resistor does not match an expected value i.e. indicating an unauthorised battery.

In view of the foregoing description, it will be evident to a person skilled in the art that various modifications may be made within the scope of the

invention. In particular, the telephone may be capable of operating with more than two different battery types in which each type would be identified by its own unique resistance value. Furthermore the different battery type need not merely be a battery having a different electrical capacity, but may indeed have a different chemical or physical composition and therefore require a different charging regime which can thus be provided in response to the identifying signal sensed within the telephone.

CLAIMS

1. A hand portable radio telephone adapted to have removably connected thereto a battery selected from at least two different types of battery, said battery comprising means for identifying the battery type, wherein the telephone comprises means responsive to said identifying means for determining the type of battery connected thereto, the battery further comprising a plurality of rechargeable cells disposed within a housing, characterized in that the individual cells are elongate and disposed in side-by-side relationship, in that the housing is adapted to enclose said cells intimately at least in the lateral direction, and in that the housing provides an internal cavity adjacent the ends of said cells, the identifying means being disposed within said cavity.

2. A hand portable radio telephone as claimed in claim 1, wherein the determining means includes means for generating a predetermined signal, and the identifying means is adapted to modify the predetermined signal to provide a signal indicative of the battery type.

3. A hand portable radio telephone as claimed in claim 1 or claim 2, wherein the identifying means comprises a first resistor, the resistance thereof being representative of the battery type, and the battery type determining means comprises a second resistor connected to a voltage source, said first and second resistors being connected in series when the battery is connected to the telephone.

4. A hand portable radio telephone as claimed in claim 3, wherein the battery type determining means further comprises means for sensing the voltage between said first and second resistors.

5. A battery for use in a hand portable radio telephone, comprising

a housing,

a plurality of rechargeable cells disposed within said housing, and

means for identifying the battery type, characterised in that

the individual cells are elongate and disposed in side-by-side relationship,

the housing is adapted to enclose said cells intimately at least in the lateral direction, and

the housing provides an internal cavity adjacent the ends of said cells, the identifying means being disposed within said cavity.

6. A battery as claimed in claim 5, wherein the identifying means comprises a resistor, the resistance thereof being representative of the battery type.

7. A battery as claimed in claim 5 or claim 6, further including means for generating a signal indicative of the temperature in the locality of the rechargeable cells.

8. A battery as claimed in any of claims 5 to 7, wherein the rechargeable cells are substantially rectangular.

9. A battery as claimed in any of claims 5 to 8, including means for electrically connecting the battery to the portable telephone, the connecting means comprising connectors associated respectively with the positive and negative terminals of said cells and with the identifying means, the connectors being mounted in a unitary insulating member.

10. A battery as claimed in claim 9 when dependant on claim 7, the connecting means comprising a further connector associated with the means for generating a temperature indicative signal, said further connector also being mounted in said unitary insulating member.

11. A battery as claimed in claim 9 or claim 10, wherein the connectors are arranged in a straight line in said unitary insulating member.

12. A hand portable telephone adapted to have removably connected thereto a battery selected from at least two distinct battery types, substantially as herein described with reference to Figures 1 and 2 of the accompanying drawings.

13. A battery for use in a hand portable telephone, substantially as herein described with reference to Figures 1 and 2 of the accompanying drawings.

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